

$$W_{\text{opt}}(e^{j\omega}) = \frac{S_{dx}(e^{j\omega})}{S_{xx}(e^{j\omega})} \quad \text{Equation 1}$$

$$W_{\text{opt}}(e^{j\omega}) = \frac{S_{dd}(e^{j\omega})}{S_{xx}(e^{j\omega})} \quad \text{Equation 2}$$

$$H_e(e^{j\omega}) = \frac{S_r(e^{j\omega})}{S_e(e^{j\omega})} \quad \text{Equation 3}$$

$$H_n(e^{j\omega}) = \frac{S_n(e^{j\omega})}{S_y(e^{j\omega})} \quad \text{Equation 4}$$

$$W(e^{j\omega}) = (1 - H_e(e^{j\omega}))(1 - H_n(e^{j\omega})) \quad \text{Equation 5}$$

$$H_e(e^{j\omega}) = \frac{S_r(e^{j\omega})}{S_e(e^{j\omega})} \quad \text{Equation 6}$$

$$H_n(e^{j\omega}) = \frac{S_n(e^{j\omega})}{S_y(e^{j\omega})}$$

$$H_e(e^{j\omega}) = \frac{S_r(e^{j\omega})}{\max(S_e(e^{j\omega}), \epsilon)}$$

$$H_n(e^{j\omega}) = \frac{S_n(e^{j\omega})}{\max(S_y(e^{j\omega}), \epsilon)} \quad \text{Equation 7}$$

$$H_e(e^{j\omega}) = \min\left(\frac{S_r(e^{j\omega})}{\max(S_e(e^{j\omega}), \epsilon)}, h_{\max}\right)$$

$$H_n(e^{j\omega}) = \min\left(\frac{S_n(e^{j\omega})}{\max(S_y(e^{j\omega}), \epsilon)}, h_{\max}\right)$$

Equation 8

$$H_e(e^{j\omega}) = \alpha H_e(e^{j\omega}) + (1 - \alpha) H_e(e^{j\omega})_{\text{prev}}$$

$$H_n(e^{j\omega}) = \alpha H_n(e^{j\omega}) + (1 - \alpha) H_n(e^{j\omega})_{\text{prev}}$$

Equation 9

$$S_y(k+1, e^{j\omega}) = 0.9 \cdot S_y(k, e^{j\omega}) + 0.1 \cdot \left\{ 1 - \left[(1 - \delta) + \delta \cdot H_e(k, e^{j\omega}) \right]^p \right\} \cdot S_e(k, e^{j\omega})$$

$$S_r(k+1, e^{j\omega}) = (1 - \beta_e) \cdot S_r(k, e^{j\omega}) + \beta_e \cdot \left[(1 - \delta) + \delta \cdot H_e(k, e^{j\omega}) \right]^p \cdot S_e(k, e^{j\omega})$$

$$S_n(k+1, e^{j\omega}) = (1 - \beta_r) \cdot S_n(k, e^{j\omega}) + \beta_r \cdot \left[(1 - \delta) + \delta \cdot H_r(k, e^{j\omega}) \right]^p \cdot S_y(k, e^{j\omega})$$

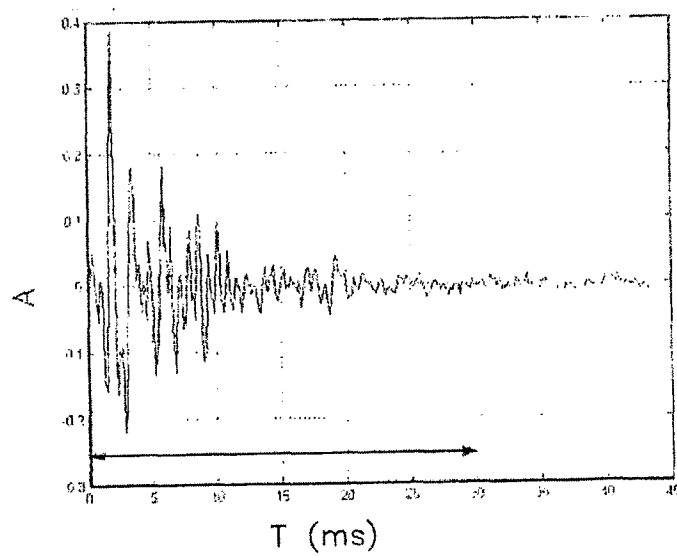
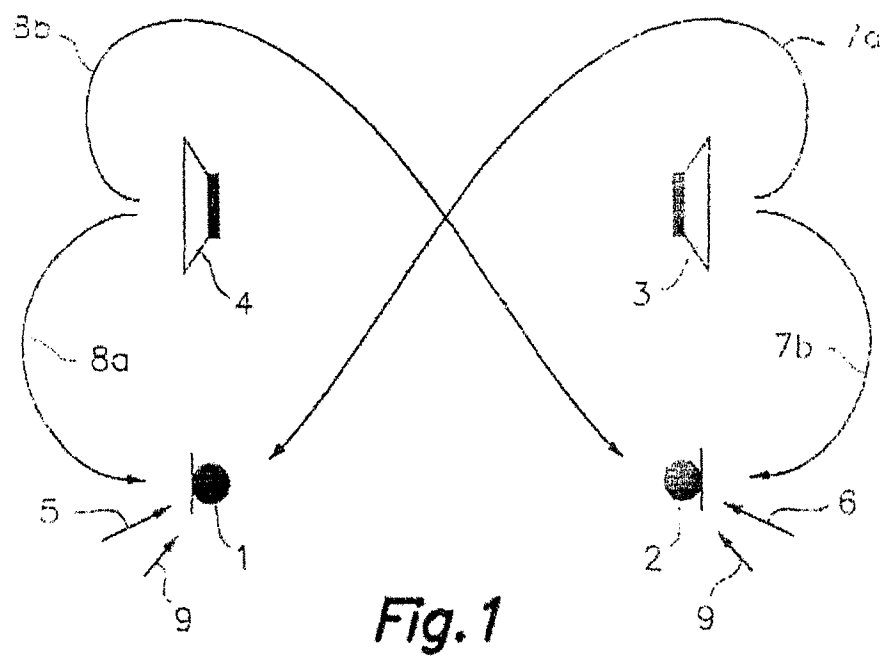
Equation 10

$$S_r(e^{j\omega}) = S_e(e^{j\omega}) |H_e(e^{j\omega})|^2$$

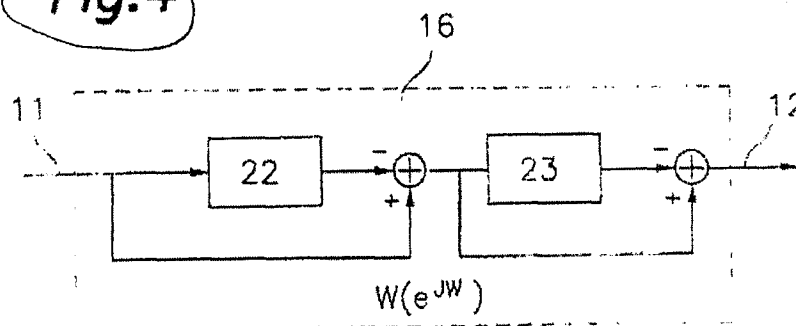
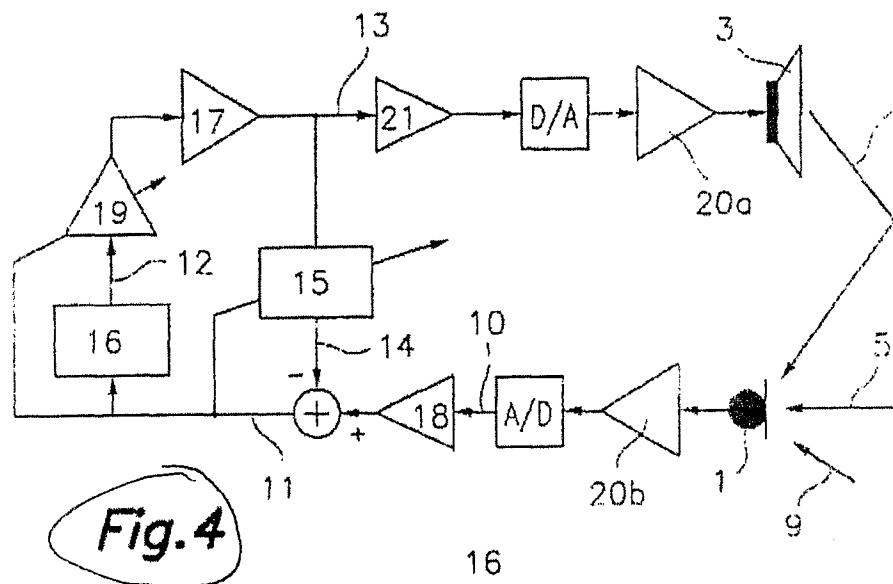
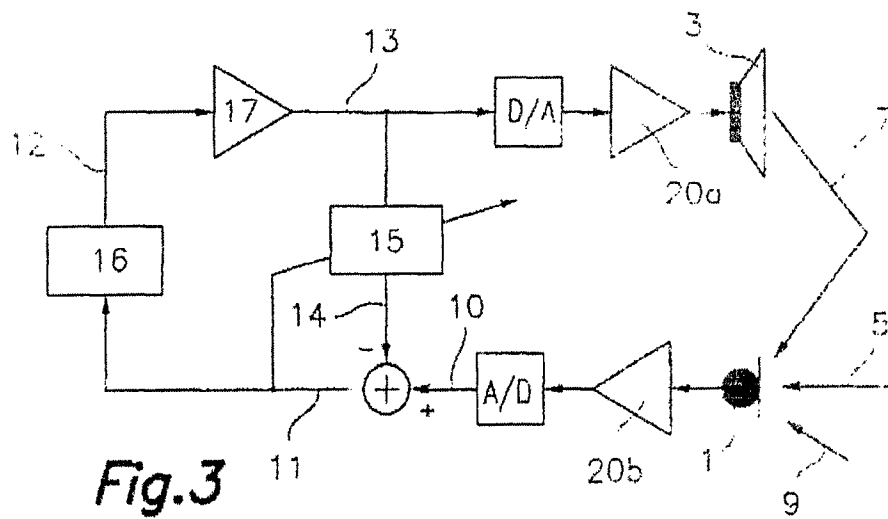
$$S_n(e^{j\omega}) = S_y(e^{j\omega}) |H_n(e^{j\omega})|^2$$

Equation 11

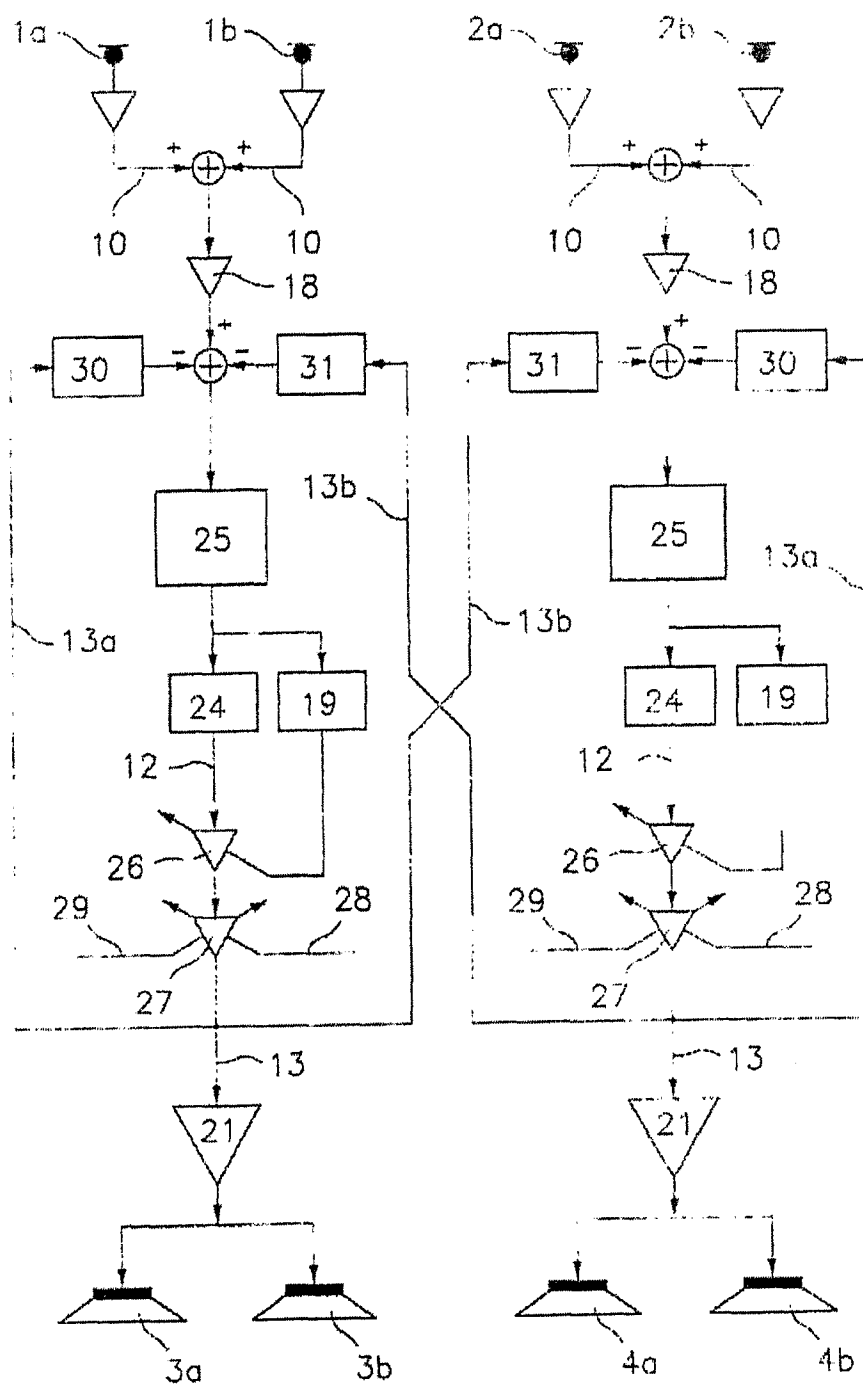
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**Fig. 6**

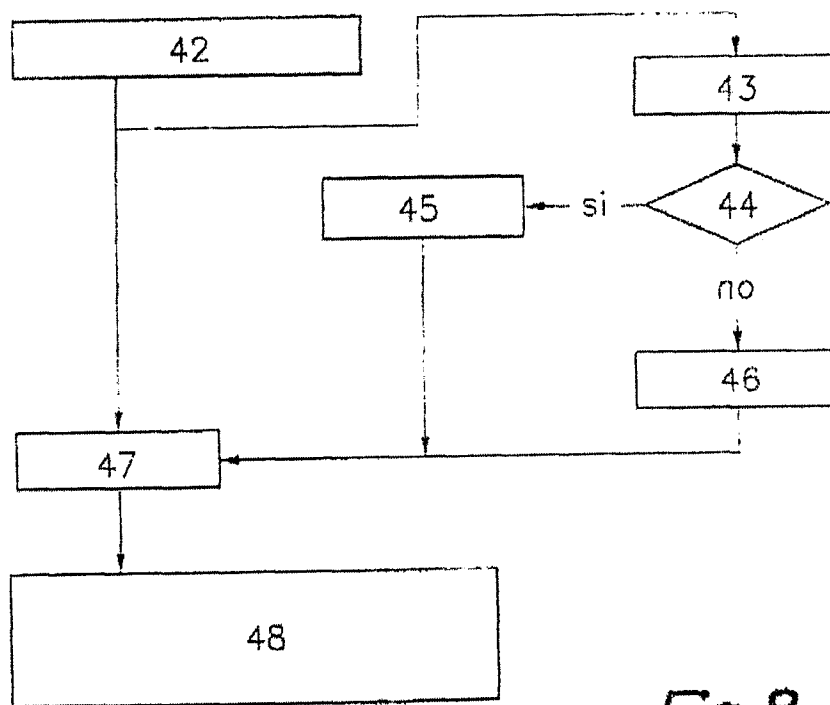
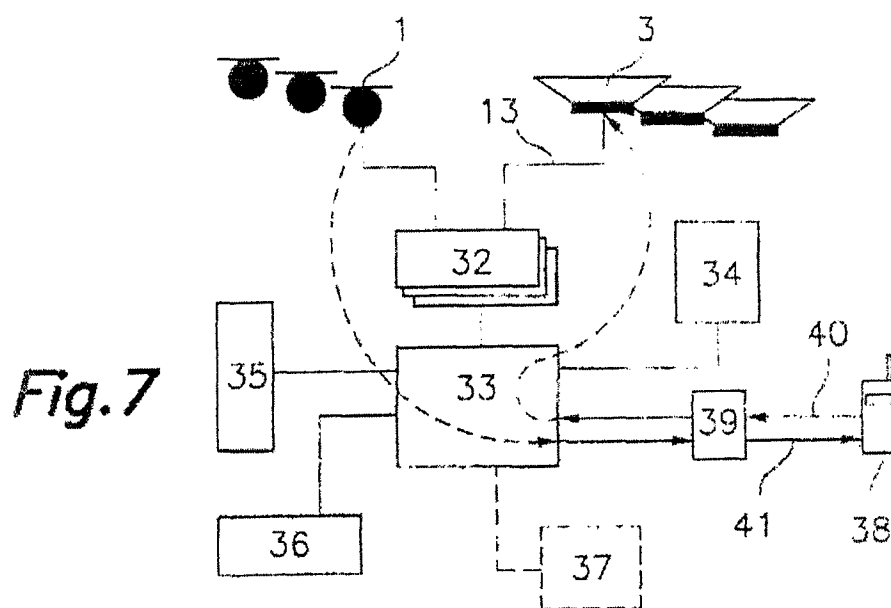
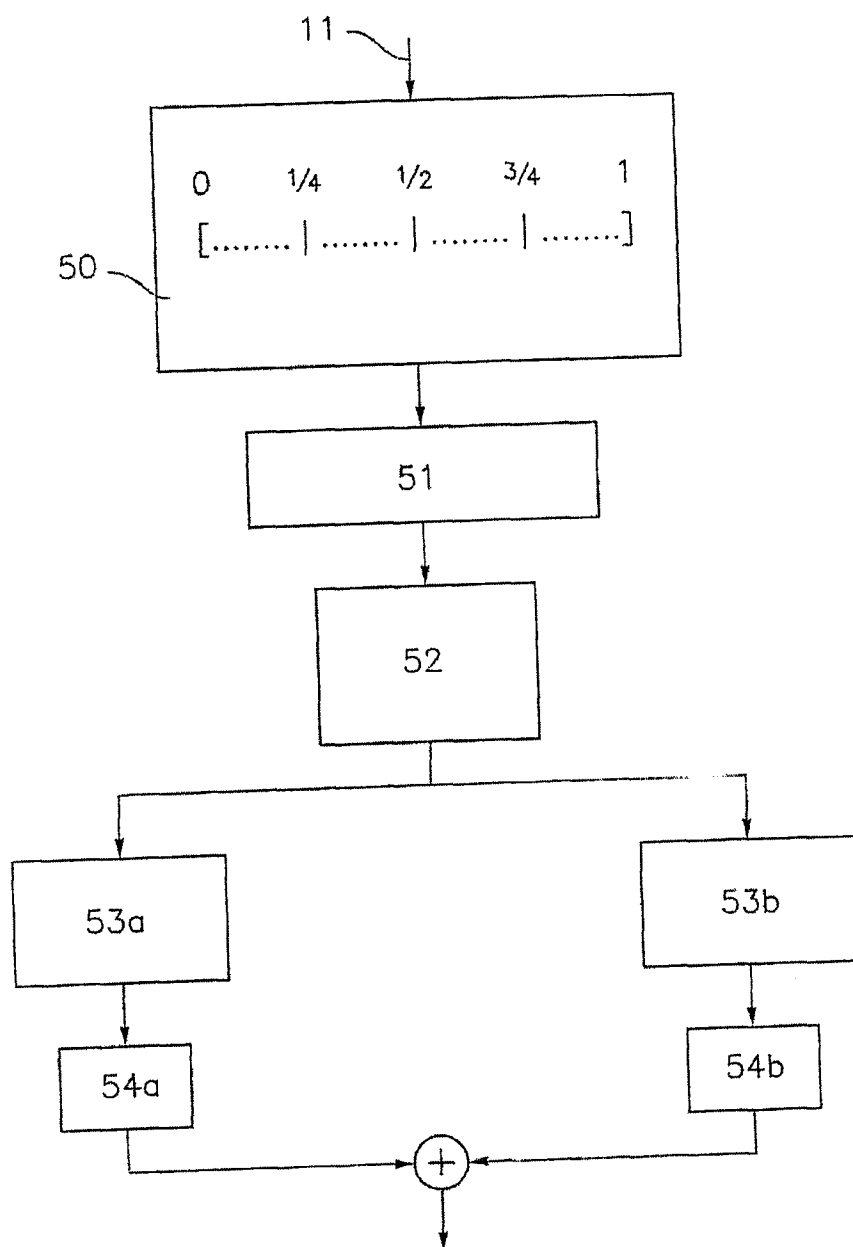


Fig. 8

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*Fig. 9*